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13. ABSTRACT (Maximum 200 words) <p>THE OBJECTIVES OF THIS RESEARCH ARE TO CONDUCT LABORATORY EXPERIMENTS THAT WILL PREDICT THE PHOTOCHEMICAL AND BIOLOGICAL TRANSFORMATIONS OF DCPD AND DIMP IN THE SOILS AND WATERS OF ROCKY MOUNTAIN ARSENAL AND WILL PROVIDE A SEMIQUANTITATIVE EVALUATION OF DECOMPOSITION RATES OF AND PRODUCTS RESULTING FROM DCPD AND DIMP. DURING JULY, THIS PROJECT WAS INITIATED AND PRELIMINARY INVESTIGATIONS IN ANALYTICAL CHEMISTRY, MICROBIOLOGY, AND PHOTOCHEMISTRY WERE PERFORMED. ARRANGEMENTS HAVE BEEN MADE TO COLLECT FIELD SAMPLES AT ROCKY MOUNTAIN ARSENAL IN AUGUST. THIS WILL ENABLE US TO INITIATE THE STUDIES TO OBTAIN ACCLIMATED CULTURES FOR THE BIODEGRADATION PHASE OF THIS PROJECT. ANALYTICAL WORK ON DCPD WILL CONTINUE, AND THE PHOTOCHEMICAL STUDIES WILL BE INITIATED. EXHIBIT A IS A PRELIMINARY PERFORMANCE SCHEDULE FOR THIS PROJECT. EXHIBIT B DEPICTS THE EXPENDITURE OF FUNDS.</p> <p style="text-align: center;"><b>DTIC QUALITY INSPECTED 3</b></p>				
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Rocky Mountain Arsenal  
Information Center  
Commerce City, Colorado

STUDIES OF ENVIRONMENTAL FATES OF DIMP AND DCPD

## Monthly Progress Report 1

4 August 1978

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## Introduction

The U.S. Army Medical Bioengineering Research and Development Laboratory has the responsibility of developing environmental standards for pollutants that contaminate the environment at Army installations. Two such pollutants at the Rocky Mountain Arsenal are dicyclopentadiene (DCPD) and diisopropylmethylphosphonate (DIMP).

The objectives of this research are to conduct laboratory experiments that will predict the photochemical and biological transformations of DCPD and DIMP in the soils and waters of Rocky Mountain Arsenal and will provide a semiquantitative evaluation of decomposition rates of and products resulting from DCPD and DIMP.

## Progress

During July, this project was initiated and preliminary investigations in analytical chemistry, microbiology, and photochemistry were performed.

### Analytical Chemistry

Arrangements were made with the project officer to have samples of DIMP, isopropylmethylphosphonate, and methylphosphonic acid shipped to SRI.

DCPD, obtained from Columbia Organic Chemicals (purity 99%), was found to be 96% pure by gas chromatographic analysis. Analysis of the impurities by gc/ms showed that they were mainly oxygenated derivatives of DCPD (see Figure 1 and attachments). These derivatives may be expected in photochemical or microbial transformation studies.

### Biodegradation

A preliminary test for toxic effects of DCPD was conducted with microorganisms collected from a eutrophic pond in Woodside, California, and from SRI soil. Mixed cultures of microorganisms were grown for 24 hr in shaker flasks containing basal salts medium with glucose and yeast extract at 25° C. These organisms were used to inoculate media containing 10 and 50 ppm DCPD. Microbial growth was measured by the turbidity of the broths. Table 1 presents the average turbidities of duplicate flasks after 16 and 40 hours of growth compared with control flasks. These data indicate that DCPD does not inhibit the growth of these organisms at up to 50-ppm concentration levels.

Table 1

## EFFECT OF DCPD ON CELL GROWTH

<u>Microorganism Source</u>	<u>DCPD Concentration (ppm)</u>	<u>Turbidity (% of Control)</u>	
		<u>at 16 hr</u>	<u>at 40 hr</u>
Eutrophic pond water	0 (control)	100	100
	2	99	100
	10	100	101
	50	99	102
SRI soil	0	100	100
	2	99	99
	10	100	99
	50	97	102

Photochemistry

A preliminary analysis of the uv spectrum of DCPD has shown that the extinction coefficients above 230 nm are less than  $83 \text{ molar}^{-1} \text{ cm}^{-1}$ . More spectra will be measured for accurate determination of the extinction coefficients (or lower limits), especially in the solar spectrum region above 290 nm.

Future Work

Arrangements have been made to collect field samples at Rocky Mountain Arsenal in August. This will enable us to initiate the studies to obtain acclimated cultures for the biodegradation phase of this project.

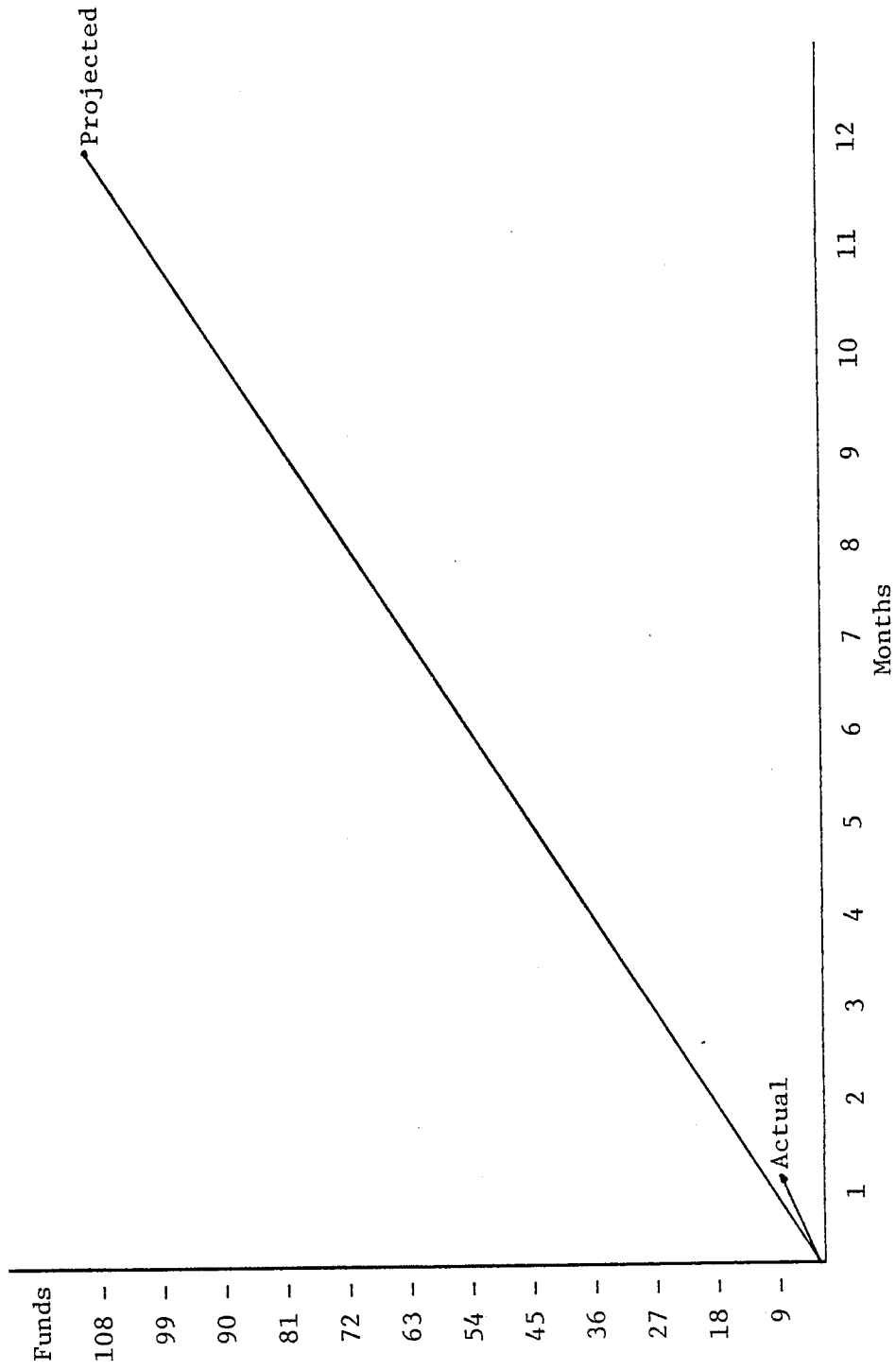
Analytical work on DCPD will continue, and the photochemical studies will be initiated.

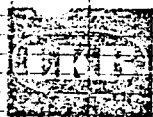
Exhibit A is a preliminary performance schedule for this project. Exhibit B depicts the expenditure of funds.

# EXHIBIT A PERFORMANCE SCHEDULE FOR PROJECT TASKS

TASK DESCRIPTION	1	2	3	4	5	6	7	8	9	10	11	12
	Months											
Sample collection												
Photochemical studies of DIMP												
Photochemical studies of DCPD												
Culture acclimation												
Biodegradation of DIMP												
Mineralization, DIMP water												
Mineralization, DIMP soil												
Soil activation, DIMP												
Biodegradation, DCPD												
Mineralization, DCPD water												
Mineralization, DCPD soil												
Soil activation, DCPD												
Product identifications												
Monthly reports	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲
Final report												▲
	4	8	12	16	20	24	28	32	36	40	44	48
	Weeks											

# EXHIBIT B EXPENDITURES





# GAS CHROMATOGRAM

No. \_\_\_\_\_ Date \_\_\_\_\_ Sign. \_\_\_\_\_  
Vol. Inj. \_\_\_\_\_ Conc. \_\_\_\_\_ Solvent \_\_\_\_\_  
Sample \_\_\_\_\_  
Temp. Ft. Heater °C \_\_\_\_\_ Mol. Smp. °C \_\_\_\_\_  
Col. Inj. °C \_\_\_\_\_ Hel. Flow ml/min \_\_\_\_\_  
Reorder Speed \_\_\_\_\_ Gain \_\_\_\_\_  
Note \_\_\_\_\_

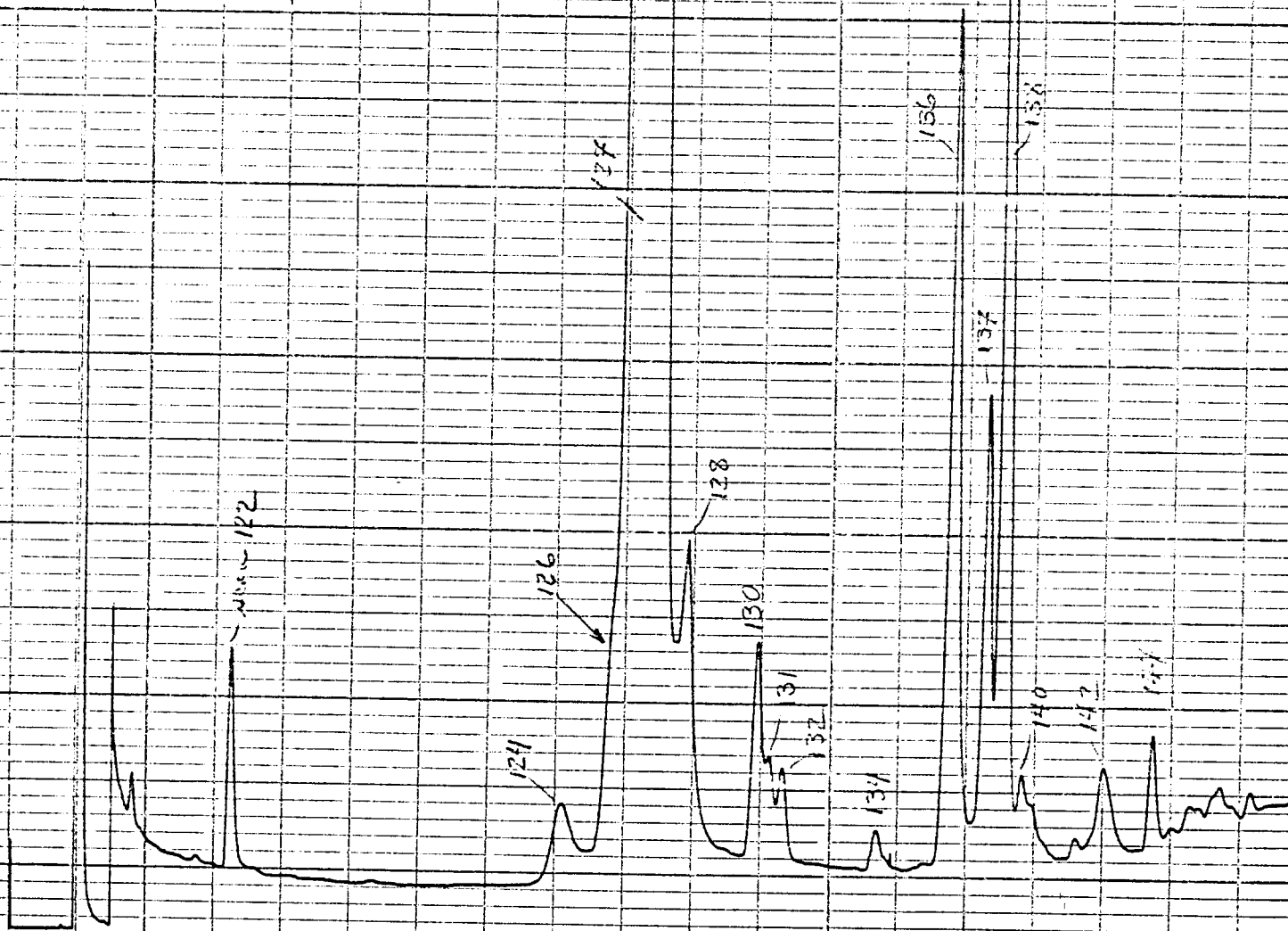
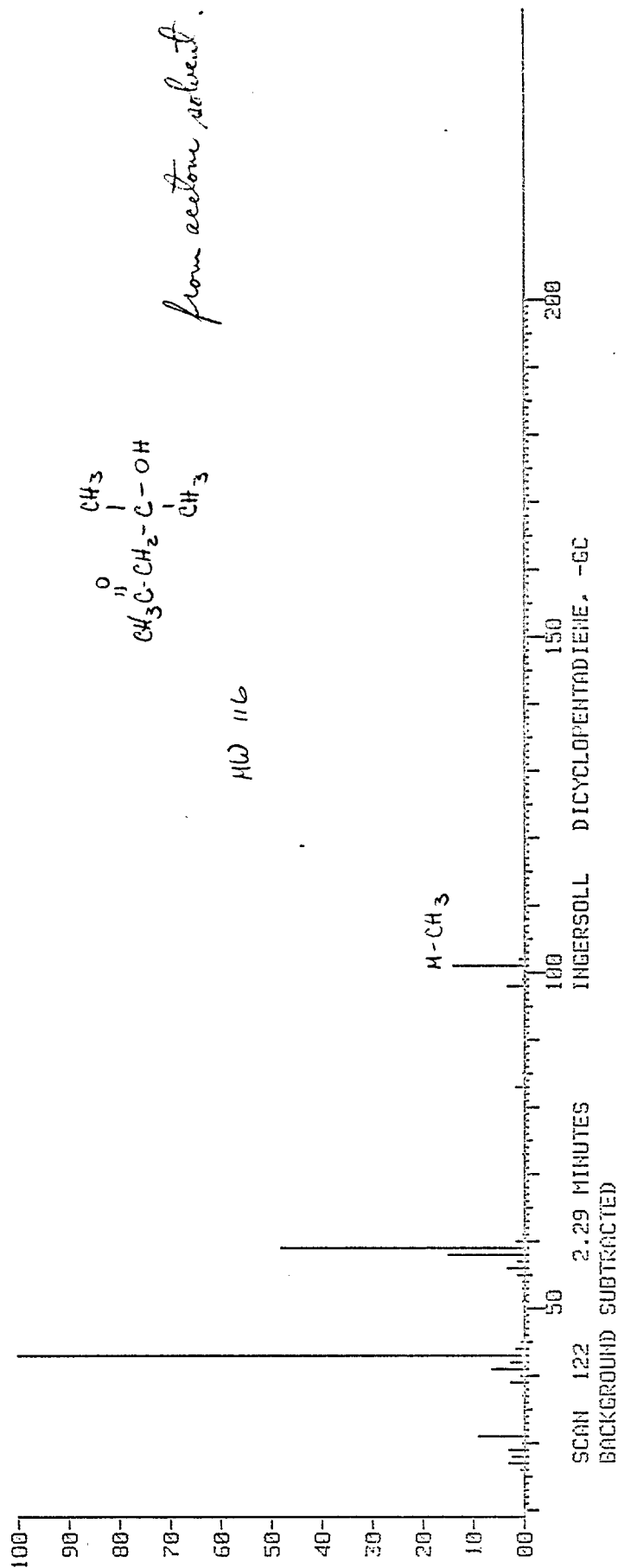


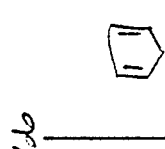
Figure 1 GC/MS Chromatogram of PCPD

PERKIN-ELMER

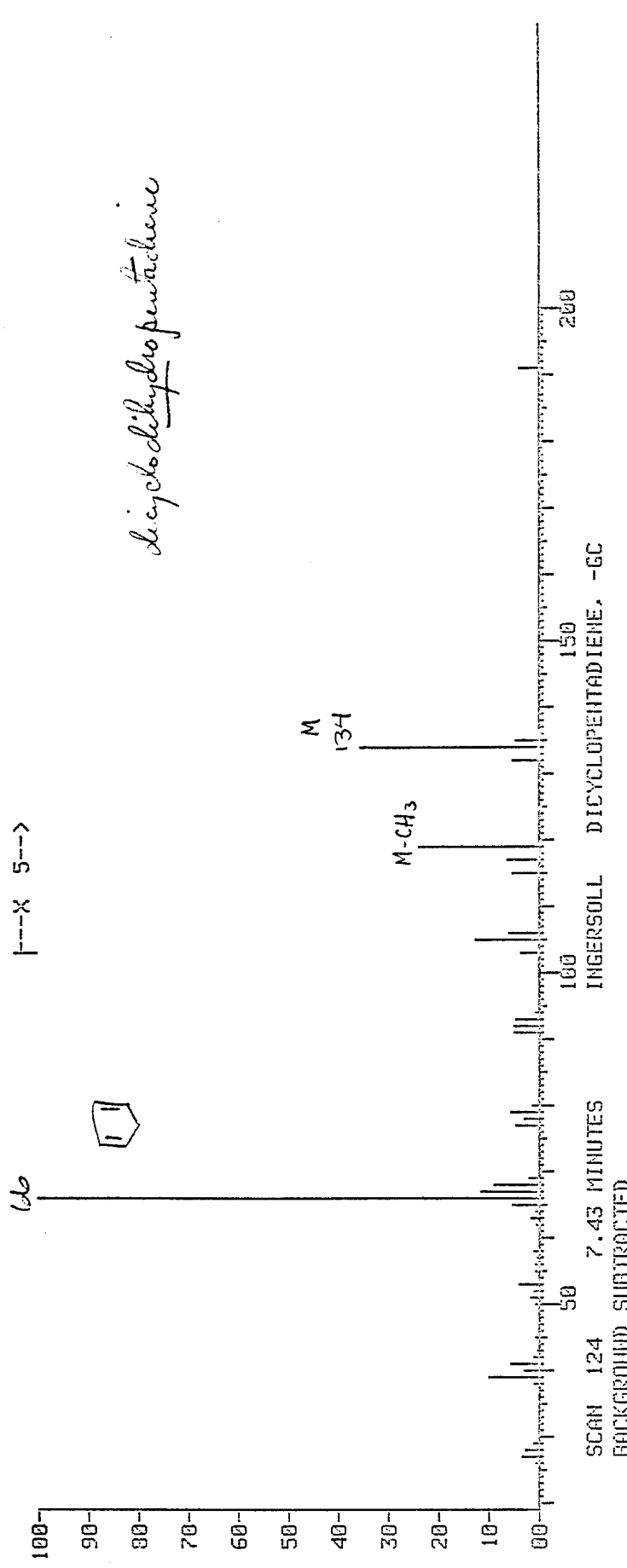


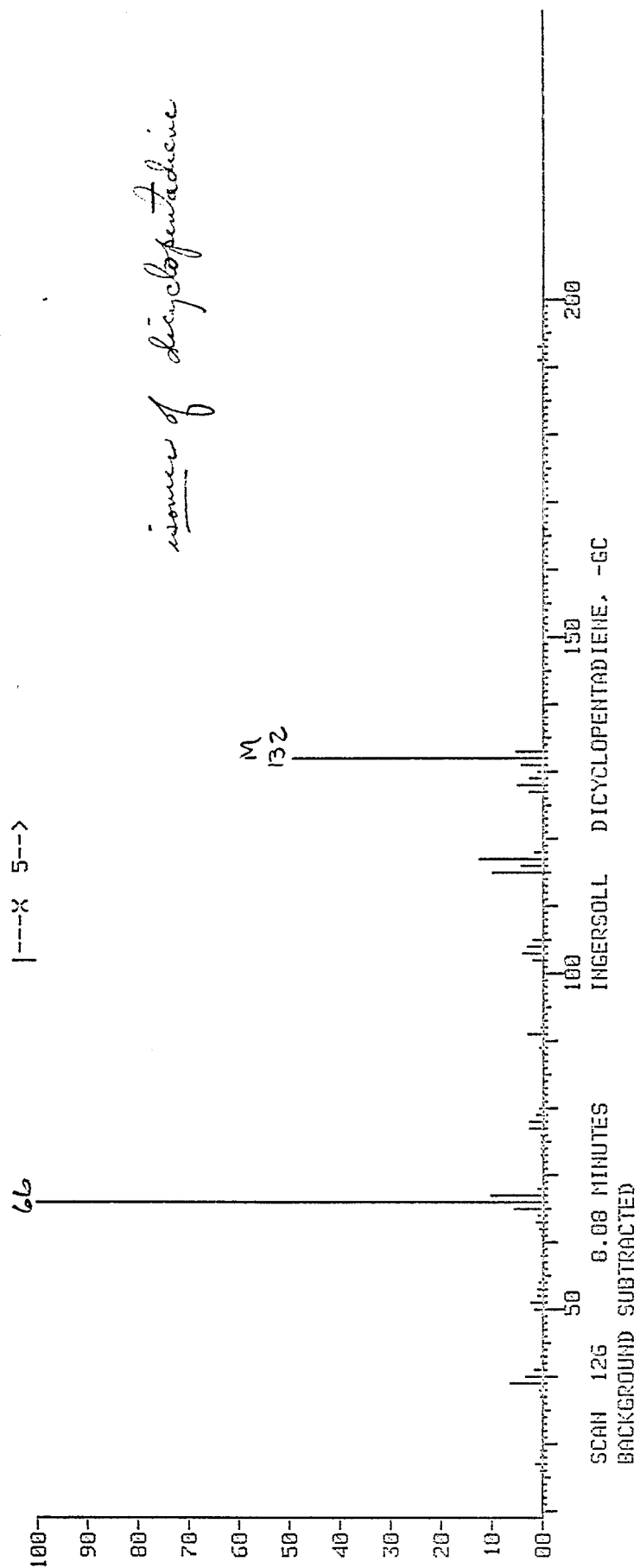


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dicyclopentadiene

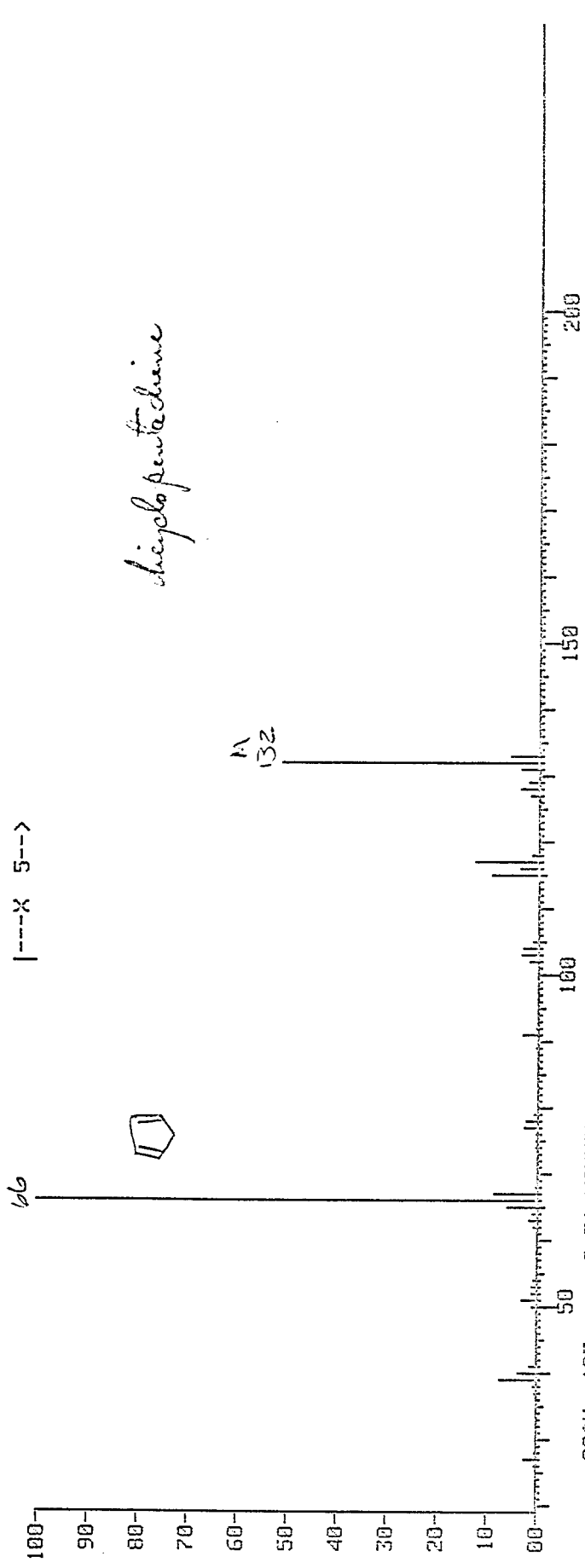


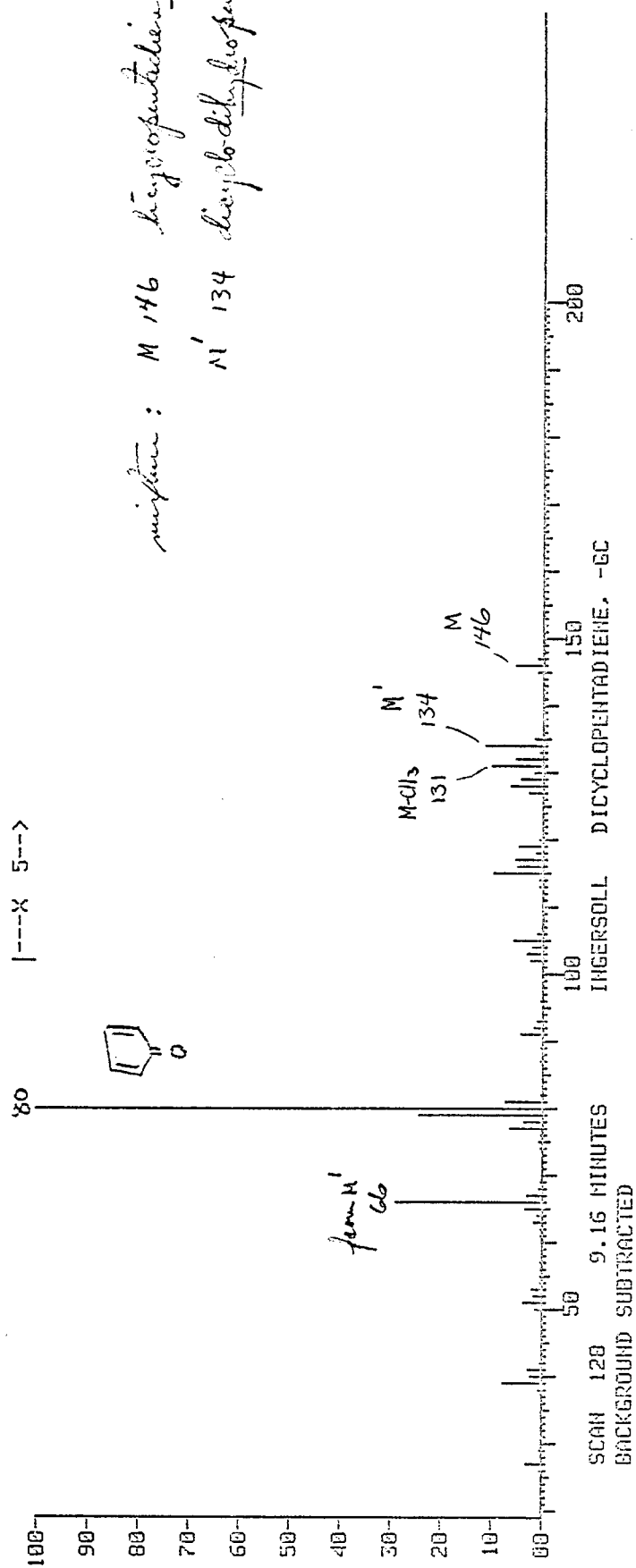


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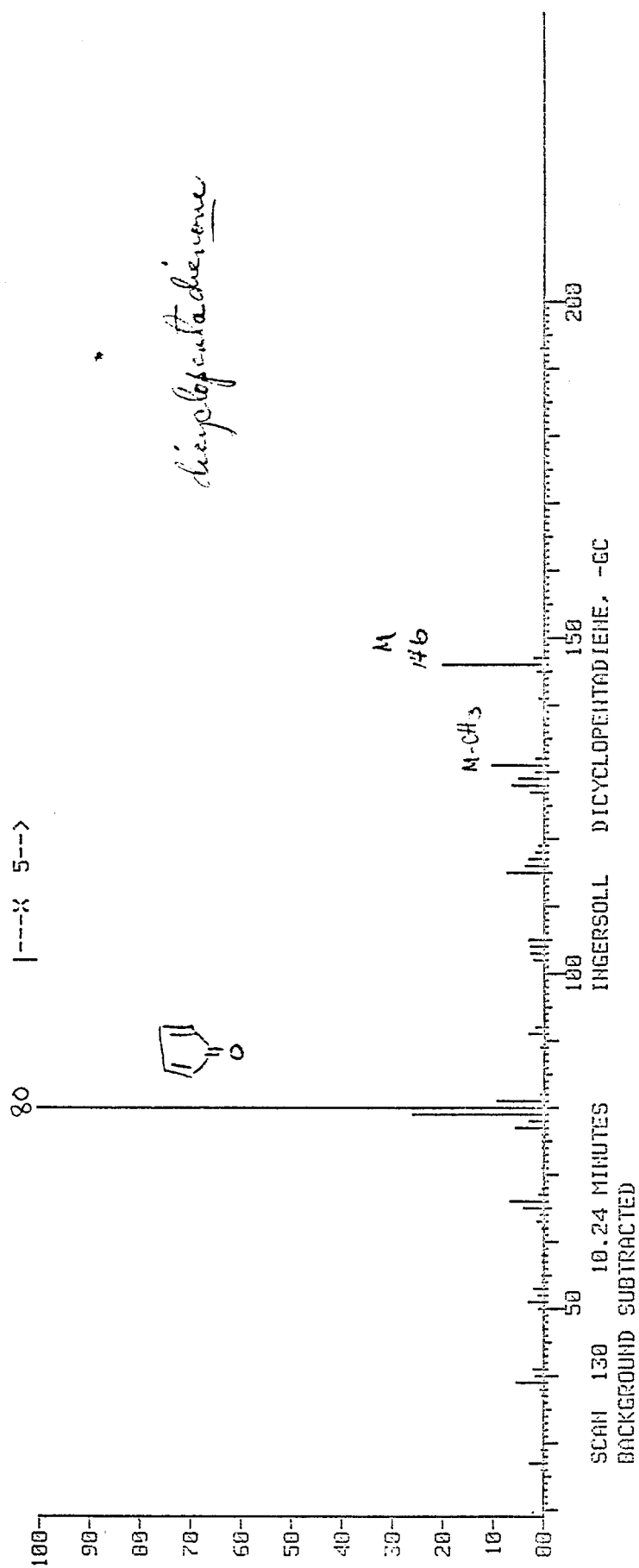


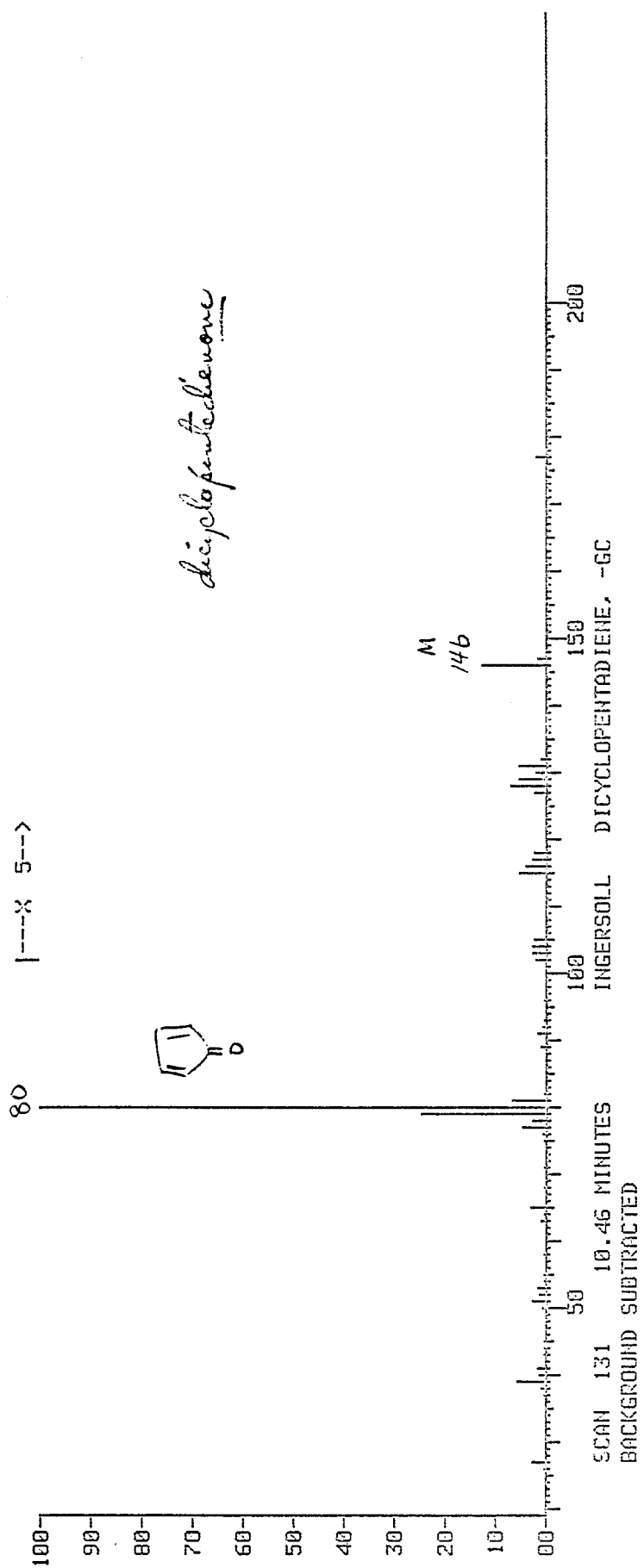
*dicyclopentadiene*





mixture: M 146 hexapentadiene (major)  
 M' 134 dicyclopentadiene (minor)





1---X 5-->

80

100-  
90-  
80-  
70-  
60-  
50-  
40-  
30-  
20-  
10-  
00-



*dicyclopentadienone*

M  
146

200

150

100

50

SCAN 132 10.61 MINUTES  
BACKGROUND SUBTRACTED  
INGERSOLL DICYCLOPENTADIENE, -GC

